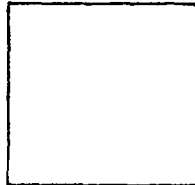


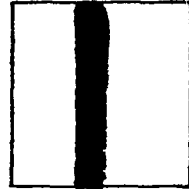
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REPORT NO. 361/2

NOTES ON RED LEAD PAINT

By

P. R. Kostling

INDEXED

November 17, 1936

WATERTOWN ARSENAL

WATERTOWN, MASS.

Report No. 361/2  
Watertown Arsenal

31 ✓  
November 17, 1936

NOTES ON RED LEAD PAINT

Object: To prepare a bulletin covering the most effective method of using red lead paint as a priming coat on steel.

Recommendations:

The following is recommended as being applicable to the needs of this arsenal.

BULLETIN

Red Lead for Priming Steel as Described in  
Federal Specification TT-R-191.

1. Grade 95% only shall be purchased except as noted in paragraph 3.
2. If being purchased to replenish stock, dry powder, 95% grade, shall be ordered. If paint will be used within 3 months, paste may be purchased. Paste is preferable to dry powder.
3. Grade 85% shall be purchased only as dry powder and only if specified for a particular job. Steel for under water service should be painted with red lead containing a high percentage litharge for the finish coat. Such red lead may be obtained by grinding 7% litharge into the 95% grade or using the 85% grade.
4. Paint made up from 95% grade red lead and stored in open containers for periods less than a week may be used, but skin and hard particles shall be removed by straining through cheesecloth

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before using. Paint containing litharge or 85% grade red lead shall be used within 8 hours after preparation and shall be discarded and thrown out if older than 8 hours.

5. The following formulae shall be used to make up paint for protecting steel in Army Ordnance Structures against out-door weathering.

Red Lead Powder

	<u>1st Coat</u>	<u>2nd Coat</u>	<u>3rd Coat</u>
Red Lead Powder, 95% Grade	20 lbs.	20 lbs.	If used,
Raw Linseed Oil	5 pts.	5 pts.	same as
Turpentine	2 gills	2 gills	1st 2nd Coat
Drier	2 gills	2 gills	or Al
Lampblack paste		1/2 gill	paint.
Yield	1 gal.	1 gal.	

Red Lead Paste

	<u>1st Coat</u>	<u>2nd Coat</u>	<u>3rd Coat</u>
Red Lead Paste, 95% Grade	20 lbs.	20 lbs.	If used,
Raw Linseed Oil	3 pts.	3 pts.	same as
Turpentine	2 gills	2 gills	1st Coat,
Drier	2 gills	2 gills	or Al
Lampblack paste		1/2 gill	paint.
Yields, paint, approx.	1 gal.	1 gal.	

All paint shall be strained through double thickness of cheesecloth after mixing and before using.

All steel shall be cleaned free of rust or mill scale by scraping, sandpapering, brushing, sandblasting, or pickling. All surfaces shall be free of grease, oil, dirt, etc., removed with proper solvents, soaps, etc. All surfaces to be painted shall be dry. The surface temperature shall be above the dew point and shall always be above 32°F unless specific instructions are given to the contrary. No surface shall be painted cut-of-doors during rain, etc.

One week shall elapse between applications of coats of paint.

#### References:

- (1) Correspondence W. A. 470.1/3898, Bureau of Standards
- (2) Letter Circular LC 422 Bureau of Standards, "The Painting of Structural Steel".
- (3) Correspondence W. A. 470.1/3897, Bureau of Standards
- (4) " W. A. 470.1/3903, National Lead Co.
- (5) " W. A. 470.1/3902, Institute of Paint & Varnish Research
- (6) Deterioration of Structures in Sea Water, S. M. Dixon & H. J. Grose, H. M. Stationery Office, London, p. 81-107.
- (7) Student Officers' Lecture Notes, "Corrosion"
- (8) Structural Metal Painting, A. H. Sabin, 1929
- (9) Miscellaneous

#### Introduction:

Request was made that factual data be collected regarding the most effective method of using red lead as a priming coat on steel.

In studying paint, not only must the pigment, vehicle, driers, thinners, and adulterants and method of mixing be observed, but also the surface upon which the paint will be placed must be observed, and also the type of exposure must be considered.

This paper is by no means an extended summary of all records on painting steel for protection against outdoor weathering and under water service. Only limited information pertaining to certain questions which were asked is given in the following. Numbers in parenthesis refer to the source of information as listed in References.

#### Available Information:

Red Lead pigment can be purchased in various degrees of purity. The Federal Specifications recognize two, viz., 85% min.  $Pb_3O_4$  and 95% min.  $Pb_3O_4$ . The other constituent, except for 1% impurities, is  $PbO$ .

This divides red lead pigments into "setting" and "non-setting" varieties. The former were the only ones available before the past decade. The availability of 95%  $Pb_3O_4$  fostered the development of red lead paste. In general, red lead paste is to be preferred to dry red lead, but only if it is to be used within 3 months after shipment from the manufacturer (2). If the purity of  $Pb_3O_4$  can be raised and its particle size decreased, this 3-month period can be extended, but the Federal Specifications do not allow for this.

For outdoor weathering, a high percentage  $Pb_3O_4$  is preferable; for under water service more  $PbO$  in the  $Pb_3O_4$  is preferable (6, 7, 8).

Provided paint has satisfactory texture, it makes no difference how long after mixing the paint is applied, up to several weeks at least (3, 4, 5, 6).

The pigment should not be thinned excessively for fullest protection despite the fact that, compared to thin paint, heavier paint requires more energy to apply, is more difficult to brush out, and is more difficult to mix in the painter's pot (9, 6, 8, 2). Most adulterants tend to have less inhibitive action and tend to be less opaque to ultra-violet light (therefore permit faster breakdown of vehicle) and tend to lower the elasticity of the dried linseed oil film, so that high grade material should be used in the paint, too much thinning should not be allowed, and too much drier should be prohibited (9, 7, 2).

Multiple coats are superior to single coats (6, 9, 2). The second coat should be colored perceptibly different from the first and third coats (2, 8, 9). The time between application of coats should not be shorter than one week (2, 4, 5, ). If it is necessary to apply the second coat within 4 days, a different vehicle should be used (4, 9).

The degree of adhesion of linseed oil paints to metal differs according to the metal, other things being equal (8, 9). In general, the adhesion to steel is better than to other metals.

All rust, grease, scale, dirt, water, etc., must be removed from steel before applying paint for maximum protection (6, 9, 8, 2, 7). Sandblasting is superior to pickling and to scraping (6).

Discussion:

On the basis of these references, the formula for red lead given in Navy Dept. publication, "Instructions for Painting and Cementing Vessels", is open to criticism unless the appearance of the paint and the time to dry are more important factors than best protection for a ten-year period.

This arsenal is not automatically informed of tests carried out by other arsenals on paints. Records indicate some sporadic tests are made. There is need for a continuous program for studying paints, metal preparation, etc., as industry develops new products. The idea back of rust reactive paints is logical and rational and developments should be closely followed with our own tests so that a background for judging the work of others is established.

The bulletin outlined under "Recommendations" should be put into practice.

Respectfully submitted,

P. R. Kostling.